Remarks and Arguments

Claims 1, 4-8 and 11-19 were presented for examination. Claims 1 and 13-15 have been amended.

Claims 1, 4, 5, 7, 8 and 11 have been rejected under 35 U.S.C. §102(b) as anticipated by PCT Patent Publication No. WO 99/27367 (Knoll, previously cited). The examiner states that although Knoll was previously applied in an obviousness rejection, the amendment of the claims to recite "immobilizing probe molecules" instead of "covalently bound probe molecules" has precipitated this anticipation rejection.

The Knoll reference has been discussed in detail in a previous response filed on February 6, 2007. There it was pointed out that, in the Knoll reference, nanoparticles are electrically isolated and do not form one of the electrodes of a galvanic element whereas, in the present invention, the metal surfaces of the nanoparticles form one of the electrodes of a galvanic element with the other electrode being formed by the metal surface of a counterelectrode.

However, the examiner asserts that the claims only require that a galvanic element be formed and that an "electrical property" be measured. Consequently, the claims do not require the argued limitations, which are found in the specification, but not recited in the claims, and the examiner has maintained the rejection over the Knoll reference.

In response, claim 1 has been further amended to recite, in lines 11-16, "…selecting the counterelectrode metal and the nanoparticle surface metal from an electrochemical series, introducing an electrolyte adjacent the circuit surface and establishing an electrical contact between the metal surfaces on the nanoparticles and the contact spot so that the counterelectrode and the metal surfaces of the nanoparticles form electrodes of a galvanic element…" Therefore, amended claim 1 clearly recites the electrode material selection and electrical connections necessary to form a galvanic element with the counterelectrode and nanoparticle metal surfaces forming the electrodes. Finally, in lines 18-20 claim 1 recites, "…measuring one of a current and a voltage generated between the electrodes of the galvanic element in the electronic circuits…" Amended claim 1 therefore also clearly recites that the current or

voltage between the electrodes of the galvanic cell is measured to determine the extent of the binding between the analyte and probe molecules.

Therefore, amended claim 1 now positively recites limitations that, as discussed in the previous response, distinguish it from the arrangement disclosed in the Knoll reference, which does not disclose an arrangement in which a surface coating of the nanoparticles forms one electrode of a galvanic element across which a current or voltage is measured.

Claims 4, 5, 7, 8 and 11 depend, either directly or indirectly on amended claim 1, and incorporate the limitations thereof. Therefore, these latter claims also patentably distinguish over the cited reference combination in the same manner as amended claim 1.

Claims 6, 18 and 19 have again been rejected under 35 U.S.C. §103(a) as obvious over Knoll in view of U.S. Patent No. 6,391,558 (Henkens, previously cited.) The examiner comments that the Knoll reference discloses all of the claimed limitations with the exception that it does not explicitly disclose covalent binding for immobilizing the probe molecules as recited in claim 6 or PCR amplification as recited in claims 18 and 19. However, the examiner claims that the Henkens reference discloses both covalent binding and PCR techniques in conjunction with detection of nucleic acids using electrodes with immobilized probes.

As previously discussed, the Henkens reference discloses measuring the presence and quantity of "reporter" particles by a technique in which current pulses are applied to a working electrode on which the probe molecules have been immobilized and to a reference electrode. The responses of each electrode are monitored to determine the quantity of reporter particles present. Henkens does not disclose the formation of a galvanic element that, in turn, generates an output, which can be measured, as now recited in claim 1 on which claims 6, 18 and 19 depend. Thus, neither the Knoll reference nor the Henkens reference discloses the construction of such a galvanic element.

Claims 5 and 12 have been rejected under 35 U.S.C. §103(a) as obvious over Knoll in view of U.S. Patent No. 6,207,369 (Wohlstadter, previously cited.) The examiner comments that Knoll discloses the recited limitations with the exception that it

does not disclose the use of polyene molecules to conduct electrical signals as recited in claims 5 and 12. However, the examiner indicates that Wohlstadter discloses such a use of a linking chain in the polyene class to insure low resistance transfer of electrons from an electrode.

As discussed above, the Knoll reference does not teach the formation of a galvanic element as claimed in claim 1, the parent claim of claims 5 and 12. Adding Wohlstadter to this combination does not change this conclusion because Wohlstadter detects the presence and quantity of the analyte molecules by eletrochemiluminescence, not by forming a galvanic element and then measuring the electrical properties of that element as recited.

Claims 13, 16 and 17 have been rejected under 35 U.S.C. §103(a) as obvious over Knoll in view of PCT Patent Publication No. WO 02/054052 A1 (Fish, previously cited.) The examiner comments that Knoll discloses the recited limitations with the exception that it does not disclose moving a countersurface to press nanoparticles against a contact spot, but the examiner indicates that Fish discloses the detection of analyte molecules with an electrode-based scheme in which an opposing surface with an electrode is moved to make contact with an electrically-readable particle.

The Fish reference has been discussed in detail in the previous response mentioned above. Combining Fish with Knoll would not produce an arrangement which forms a galvanic element and measures the voltage or current across the electrodes of this element because Knoll does not disclose the recited galvanic element and Fish detects the presence and quantity of the analyte molecules by measuring electrical changes in a measuring cell, not by forming a galvanic element and then measuring the electrical properties of that element as recited. Since claims 13, 16 and 17 are dependent on amended claim 1 and incorporate the limitations thereof, they distinguish over the cited reference combination in the same manner as claim 1.

Claim 14 has been rejected under 35 U.S.C. §103(a) as obvious over Knoll in view of Fish and further in view of Wohlstadter. The examiner comments that Knoll and Fish disclose the recited limitations with the exception that they do not disclose that the analyte is collected on a surface opposite to the surface on which the detecting electrode is mounted. The examiner indicates that Wohlstadter discloses several

electrode-based detection configurations in which an analyte is collected on a surface opposite to the surface on which the detecting electrode is mounted.

The combination of Knoll and Fish has been discussed above and does not teach the formation of a galvanic element as claimed. Adding Wohlstadter to this combination does not change this conclusion because Wohlstadter detects the presence and quantity of the analyte molecules by electrochemiluminescence, not by forming a galvanic element and then measuring the electrical properties of that element as recited. Since claim 14 is dependent on amended claim 1 and incorporates the limitations thereof, it distinguishes over the cited reference combination in the same manner as claim 1.

Claim 15 has been rejected under 35 U.S.C. §103(a) as obvious over Knoll in view of Fish in view of Wohlstadter and further in view of an article entitled "Metal Nanoparticle-Based Electrochemical Stripping Potentiometric Detection of DNA Hybridization" (Wang, previously cited.) The examiner comments that Knoll and Fish and Wohlstadter disclose the recited limitations with the exception that they do not disclose that that an analyte molecule/particle complex is first bound to a surface via a probe molecule and then later the bond is broken and the freed complex detected. However, the examiner comments that the Wang reference discloses binding gold nanoparticles to a target oligonucleotide and then later separating the gold nanoparticle and detecting it at an electrode.

As discussed above, the combination of Knoll, Fish and Wohlstadter does not teach the formation of a galvanic element as claimed. Adding Wang to this combination does not change this conclusion because Wang detects the presence and quantity of the analyte molecules by stripping gold nanoparticles from their bound relationship with the analyte molecules by electrochemical reactions at a working electrode and then measuring electrical changes at the working electrode by potentiometric means, not by forming a galvanic element and then measuring the electrical properties of that element as recited. Since claim 15 is dependent on amended claim 1 and incorporates the limitations thereof, it distinguishes over the cited reference combination in the same manner as claim 1.

In light of the forgoing amendments and remarks, this application is now believed in condition for allowance and a notice of allowance is earnestly solicited. If the examiner has any further questions regarding this amendment, he is invited to call applicants' attorney at the number listed below. The examiner is hereby authorized to charge any fees or direct any payment under 37 C.F.R. §§1.17, 1.16 to Deposit Account number 50-3969.

Respectfully submitted

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